



Development of Tennessee UHPC for Bridge Applications

Problem Description

Ultra-high-performance concrete (UHPC) is an advanced cement-based composite material, typically made with higher contents of cementitious materials. The compressive strength of UHPC is significantly higher than that of traditional concrete, and this higher strength of UHPC leads to reduced cross-sections of structural elements such as bridge decks, piers, abutments, beams, or columns. Reduced cross-sectional areas may lead to lower cost without sacrificing performance. The Tennessee Department of Transportation (TDOT) has not utilized UHPC in any project to date. The main concern of UHPC is the higher initial costs. TDOT does not have standard specifications for road and bridge construction with the utilization of UHPC. However, these higher initial costs may be offset by smaller structural sections and/or lower service life.

Research Objectives

The primary objectives of this study are to:

- Synthesis Report on UHPC - The objective of the synthesis report is to increase TDOT's knowledge of the state of the art and practice in UHPC and describe current mix designs.
- Representative UHPC mix designs with locally sourced materials - The objective of this project is to increase TDOT's knowledge about the mix design on the UHPC, utilizing locally sourced materials obtained from Tennessee.
- TDOT UHPC Specification - Another objective of this project is to develop a special provision to the TDOT standard specifications for road and bridge construction for the use of UHPC.

Potential Implementation and Expected Benefits

TDOT will benefit from the proposed project in multiple ways:

- Increased knowledge of mix design procedures, especially those used in other states, will allow TDOT to assess the suitability of optimized non-proprietary UHPC mix design in their other projects.
- The mechanical properties of UHPC will provide TDOT with a quick, practical reference tool for the selection and implementation of UHPC in other projects such as dams, embankments, thin overlays, claddings, and shell structures.
- The durability properties of non-proprietary UHPC will provide a comprehensive reference that TDOT can use to implement non-proprietary UHPC on their future projects especially for repairs and maintenance works.
- The Standard Specifications/Special Provisions of non-proprietary UHPC will allow and implement the TDOT plans and workflow in the new construction projects in accordance with the state of practice.
- TDOT and the residents of Tennessee will save money for the use of non-proprietary UHPC in new construction, repairs, and maintenance for road and bridge construction projects.

PROJECT NUMBER:

RES2024-04

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PROJECT SCHEDULE:

August 2023 to July 2025